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other than our own. Twelve other papers are included in the Symposium.

The volume is indispensable to the astronomer who is interested in the structure and development of galaxies. The discussions that took place at the meeting, reproduced at the ends of many of the sections, add greatly to its value.

Man's World of Sound. By John R. Pierce and Edward E. David, Jr. 287 pp. Doubleday & Co., Inc., Garden City, New York, 1958. \$5.00. *Reviewed by James MacLachlan, Earl Haig Collegiate Institute.*

In an effort to improve the efficiency of communication the Bell Telephone Laboratories have undertaken the development of a variety of talking machines. The full range of acoustics, linguistics, and physiology on which their research depends is explored by Bell scientists Pierce and David. They describe the book as "a garden of speech and hearing, in which the reader has had the way smoothed for him". It is an engaging survey of the field of speech communication.

Speech sounds travel through the air by means of waves having mathematically defined properties. They have their origin in puffs of air from the larynx, which are given form in the passages of throat, mouth, and nose, emerging as the sounds of a particular language. The sound elements of speech, phonemes, numbering about 40 in English, have a recognizable acoustic form. The process of hearing involves a number of phenomena, all of which depend on the structure and function of the ear, the nervous system, and the brain.

The electrical transmission of vocal communication through space and time requires an understanding of the nature of speech sounds, and the effect on them of electro-mechanical devices. Various technical limitations of communication channels make very attractive the possibility of reproducing speech by an analogue of the human vocal tract, which would require only a limited number of signals to control it.

The authors have provided an eminently satisfactory logical development of their material from simple elements to more complex combinations. They include a number of interesting experimental results. For example, tests show that it is possible to attach a meaning to the statement that the subjective loudness of one tone is twice as great as that of another. The influence of two-ear hearing on locating sound sources and recognizing a sound through masking noise has been investigated in a variety of ways. While the mechanisms of hearing are very incompletely understood compared to those of speaking, research seems to point to a theory which combines the effects of the positional response of the cochlea to different sounds, with the numerical response of nerve endings in the inner ear.

The discussion of effects of head cavities on speech sounds and the efforts to duplicate them by mechanical and electrical analogues is illuminating, particularly since the book includes a discussion of the acoustic properties of resonant chambers. The importance of this

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research is the possibility of using speech reproducers to provide intelligible communication on channels with bandwidths perhaps one-tenth as great as in a normal telephone circuit.

There seems to be little of significance in research on speech and hearing that the authors have not been able to include in their lucid, knowledgeable account of man's world of sound.

Vapour-Liquid Equilibrium (2nd Revised Edition). By E. Hála, J. Pick, V. Fried, O. Vilím. Translated from Czechoslovakian by G. Standart. 402 pp. Pergamon Press, London & New York, 1958. \$14.00. Reviewed by Stuart Rice, Institute for the Study of Metals, University of Chicago.

This text, designed primarily for research chemical engineers, serves three ends, each with varying efficiencies. The first part of the volume deals with a rather detailed treatment of vapor-liquid equilibrium from the standpoint of classical thermodynamics. The treatment is clear and the various relations, both empirical and nonempirical, are discussed with inclusion of sufficiently high-order terms to permit direct application to most systems. Numerical examples are used to illustrate the theory.

The second part of the text is a full description of equilibrium stills, thermometers, and manometers. The advantages and drawbacks of each particular instrument are cited. This section will be very useful to physical chemists studying the properties of mixtures.

The last section is a bibliography of 1232 papers, supposedly on liquid-vapor equilibrium. A brief check reveals that entries 391 and 684 are identical, corresponding to the two different spellings Glashan and McGlashan, that reference 216 refers to the dielectric properties of solid and liquid mixtures, and that reference 171 refers to reactions of SnCl_4 with various compounds dissolved in CCl_4 , but not to vapor-liquid equilibrium data. While the table will undoubtedly prove useful, it is not what it purports to be.

In general, this will be a useful reference text for chemical engineers and those investigators studying the properties of mixtures, but it is not sufficiently general to belong in a personal library.

Principles and Applications of Random Noise Theory. By Julius S. Bendat. 431 pp. John Wiley & Sons, Inc., New York, 1958. \$11.00. Reviewed by George L. Turin, Hughes Research Laboratories.

Dr. Bendat's book is, to say the least, disappointing. For reasons explained below, this reviewer is of the opinion that it will serve neither as an adequate textbook for the novice, nor as a valuable reference for the expert.

The book is divided essentially into two parts: the first three chapters are on noise theory, and the remaining seven are on applications of this theory. The applications, as the author points out in his preface, are